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(54) **SPRUE BUSH AND BUSH PART THEREOF**

(57) A sprue bush that is attached to a mold used to mold synthetic resin includes: a sprue bush main body (10) that has a flow passage, through which synthetic resin injected from an injection molding nozzle flows, and a recessed portion (13) formed in a surface of the sprue bush main body on a synthetic resin injection port side thereof; and a bush component (20) that is embedded in the recessed portion (13), the bush component (20) including: a nozzle contact surface (21) that is contacted by the injection molding nozzle; a through hole (22) that extends from an opening in the nozzle contact surface (21) and communicates with the flow passage in the sprue bush main body so as to form the flow passage for the synthetic resin; and a plurality of ribs (23) that extend radially outward from an inner peripheral surface of the through hole.

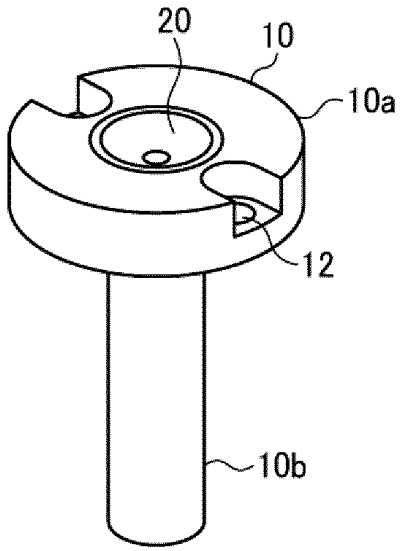

FIG. 1A

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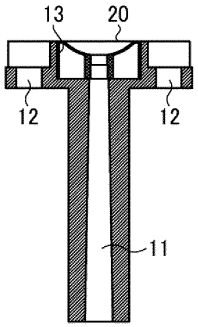


FIG. 1B

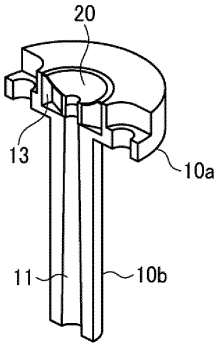


FIG. 1C

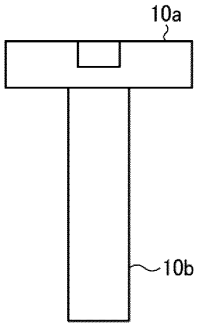


FIG. 1D

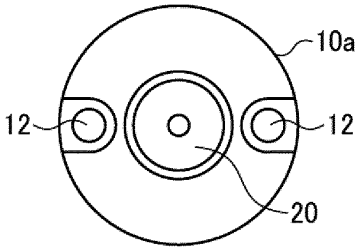


FIG. 1E

Description

TECHNICAL FIELD

[0001] The present invention relates to a sprue bush that is attached to a mold used to mold synthetic resin, and a bush component attached thereto.

BACKGROUND ART

[0002] In an example of a synthetic resin molding process implemented when injection-molding synthetic resin, a pair of molds are closed such that a cavity is formed therebetween, and molten synthetic resin is injected into the cavity. A sprue bush is a member having a flow passage (a sprue) through which synthetic resin injected from an injection molding machine is injected into the molds, and the sprue bush is attached interchangeably to the mold on the side where the synthetic resin is injected. An injection nozzle of the injection molding machine is then brought into direct contact with a nozzle contact surface of the sprue bush, whereupon the synthetic resin is injected. During the injection molding, the high-temperature, molten resin material is injected into the cavity through the sprue of the sprue bush and a runner provided in the molds, and by advancing a mold release timing, a molding cycle time can be shortened, leading to enhancement in productivity. However, when the molds are released before the resin in a sprue inlet portion hardens, stringing occurs. When, as a result, a string is trapped in a mold, problems such as variation in the shape of the mold and deterioration of the quality of a molded article occur.

[0003] In response to the problem of stringing, as described above, it has been proposed that stringing may be prevented by implementing heat diffusion in the sprue bush serving as the resin flow passage. More specifically, providing a partition plate that bisects a flow passage cross-section (an opening in the nozzle contact surface) in a resin injection port of the sprue bush (Patent Document 1), forming the opening (the flow passage cross-section) in a shape other than a circular shape, such as a six-pronged fork shape (Patent Document 2), forming the entire sprue bush from a high thermal conductivity member made of copper alloy, copper, aluminum alloy, aluminum, or the like (Patent Document 3), and embedding a high thermal conductivity member in a sprue bush main body as a component thereof (Patent Document 4) have been disclosed.

CITATION LIST

PATENT LITERATURE

[0004]

Patent Document 1: Japanese Laid-open Patent Publication No. 2001-246649

Patent Document 2: Japanese Laid-open Patent Publication No. 2008-247014

Patent Document 3: Japanese Laid-open Patent Publication No. 2007-083462

Patent Document 4: Japanese Laid-open Patent Publication No. 2014-046537

SUMMARY OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] However, in the method of Patent Document 1, the sprue cross-section through which the resin flows is obstructed by the partition plate, and therefore the fluidity of the resin deteriorates. It is therefore needed to take measures such as increasing the injection pressure, increasing the temperature of the resin in order to reduce the viscosity thereof, and reducing the cross-section of the partition plate, but as a result of these measures, deterioration of and damage to the partition plate are more likely to occur. Moreover, when a resin blockage occurs in the sprue bush, an operation to remove the resin is complicated, and therefore the partition plate may be damaged while removing the resin, leading to an increase in the frequency with which the partition plate or the entire sprue bush has to be exchanged for a new one.

[0006] It is known that by employing the method of Patent Document 2, a greater stringing suppression effect than that obtained with a circular cross-section can be realized, but under present circumstances, when even greater yield is needed, the effect is insufficient.

[0007] In the method of Patent Document 3, a high thermal conductivity member typically exhibits lower strength and wear resistance than a conventional sprue bush material, and therefore the resin flow passage may deteriorate due to wear and deformation. When the resin flow passage deteriorates, molding conditions vary, and components have to be replaced more frequently.

[0008] Furthermore, in the method of Patent Document 4, preparing and combining a plurality of metal members having different thermal conductivity values may lead to an increase in manufacturing cost.

[0009] Hence, in consideration of the problems described above, an object of the present invention is to provide a novel sprue bush with which stringing can be prevented without the use of a partition plate or a high thermal conductivity member, and a bush component forming the sprue bush.

MEANS FOR SOLVING THE PROBLEMS

[0010] A sprue bush attached to a mold used to mold synthetic resin, the sprue bush comprising a sprue bush main body that has a flow passage, through which synthetic resin injected from an injection molding nozzle flows, and a recessed portion formed in a surface of the sprue bush main body on a synthetic resin injection port side thereof, and a bush component that is embedded in

the recessed portion, the bush component including a nozzle contact surface that is contacted by the injection molding nozzle, a through hole that extends from an opening in the nozzle contact surface and communicates with the flow passage in the sprue bush main body so as to form the flow passage for the synthetic resin, and a plurality of ribs that extend radially outward from a peripheral surface of the through hole.

[0011] Further, a bush component forming the sprue bush according to the present invention is used in a sprue bush configured to include: a sprue bush main body that has a flow passage, through which synthetic resin injected from an injection molding nozzle flows, and a recessed portion formed in a surface of the sprue bush main body on a synthetic resin injection port side thereof; and the bush component, which is embedded in the recessed portion, this bush component including: a nozzle contact surface that is contacted by the injection molding nozzle; a through hole that extends from an opening in the nozzle contact surface and communicates with the flow passage in the sprue bush main body so as to form the flow passage for the synthetic resin; and a plurality of ribs that extend radially outward from an inner peripheral surface of the through hole.

ADVANTAGEOUS EFFECTS OF THE INVENTION

[0012] According to the present invention, the nozzle contact surface of the bush component is supported by the ribs, and spaces are provided between the ribs. Therefore, the plurality of radial ribs act as heat radiation fins such that the heat of the resin in the vicinity of the opening in the nozzle contact surface is radiated effectively to the spaces between the ribs. Moreover, the nozzle contact surface is reduced in thickness, thereby enhancing the effect of radiating heat from the nozzle contact surface. Hence, the vicinity of the opening is cooled with greater efficiency such that the temperature of the resin in the vicinity of the opening decreases earlier, and as a result, the occurrence of stringing is suppressed.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Figs. 1A-1E are views illustrating configurations of a sprue bush according to a first embodiment of the present invention.

Figs. 2A-2F are views illustrating configurations of the bush component 20 according to the first embodiment.

Figs. 3A-3F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment.

Figs. 4A-4F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment.

Figs. 5A-5F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment.

Figs. 6A-6F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment.

Figs. 7A-7F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment.

Figs. 8A-8E are views illustrating configurations of a sprue bush according to a second embodiment of the present invention.

Figs. 9A-9F are views illustrating configurations of the bush component 20 according to the second embodiment.

Figs. 10A-10F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment.

Figs. 11A-11F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment.

Figs. 12A-12F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment.

Figs. 13A-13F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment.

Figs. 14A-14F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment.

Figs. 15A-15D are views illustrating further modified examples of the configuration of the bush component 20 according to an embodiment of the present invention.

Fig. 16 is a sectional view illustrating a condition in which an injection molding nozzle 30 contacts the nozzle contact surface of the bush component 20 illustrated in Figs. 15A-15D.

DESCRIPTION OF EMBODIMENTS

[0014] Embodiments of the present invention will be described below with reference to the figures. However, the technical scope of the present invention is not limited to these embodiments.

[0015] Figs. 1A-1E are views illustrating configurations of a sprue bush according to a first embodiment of the present invention, wherein Fig. 1A is an external perspective view, Fig. 1B is a sectional view, Fig. 1C is a sectional perspective view, Fig. 1D is a side view, and Fig. 1E is a top view. The sprue bush according to the first embodiment is configured to include a sprue bush main body 10, and a bush component 20 that is attached to the sprue bush main body 10.

[0016] The sprue bush main body 10 is formed from a steel material having a sufficient hardness to satisfy performance necessities such as wear resistance and durability, and is formed by coaxially integrating a disc-shaped head 10a and a columnar shaft 10b having a

smaller diameter than the head 10a. A sprue (a flow passage) 11 through which molten resin injected from an injection nozzle (not illustrated) flows is formed in an axial center that extends from the head 10a to the shaft 10b. Further, a pair of screw holes 12 are provided in the head 10a, and the sprue bush main body 10 is attached fixedly to a mold by fixing screws through the screw holes 12. Furthermore, a recessed portion 13 having a columnar shape, for example, is formed in a central portion of the head 10a of the sprue bush main body 10, and the bush component 20 is embedded in the recessed portion 13.

[0017] Figs. 2A-2F are views illustrating configurations of the bush component 20 according to the first embodiment, wherein Fig. 2A is an external perspective view, Fig. 2B is a side view, Fig. 2C is a top view, Fig. 2D is a bottom view, Fig. 2E is an A-A sectional view of Fig. 2D, and Fig. 2F is a B-B sectional view of Fig. 2D.

[0018] The bush component 20, similarly to the sprue bush main body 10, is formed from a steel material having a predetermined hardness, and the type of steel material may be identical or different to that of the sprue bush main body 10. The bush component 20 is shaped to fit into the recessed portion 13, and is configured to include a nozzle contact surface 21 that is contacted by the injection molding nozzle, a through hole 22 that extends from an opening 21a in a bottom center of the nozzle contact surface 21 and communicates with the sprue 11 of the sprue bush main body 10 so as to form a synthetic resin flow passage (a sprue), and a plurality of ribs 23 that extend radially outward from a pipe-shaped portion 22a forming the through hole 22. In the example of Fig. 2, the opening 21a is circular and the through hole 22 has a circular cross-section. The bush component 20 can be manufactured using an existing processing technique such as cutting or electrical discharge machining.

[0019] The ribs 23 are rectangular thin plate portions, and are provided to extend from the pipe-shaped portion 22a at equal intervals in a circumferential direction. In the example of Fig. 2, six ribs 23 are formed. An axial direction length of the ribs 23 is determined such that an upper end side of each rib 23 is joined to a rear surface of the nozzle contact surface 21 and a lower end side of each rib 23 contacts a bottom of the recessed portion 13 of the head 10a (when the bush component 20 is embedded in the recessed portion 13). Further, a radial direction length of the ribs 23 is determined such that each rib 23 contacts a peripheral surface of the recessed portion 13 of the head 10a (when the bush component 20 is embedded in the recessed portion 13).

[0020] The nozzle contact surface 21 of the bush component 20 is a depressed curved surface that curves in a circular shape, and is formed at a substantially identical diameter to a tip end shape of the injection molding nozzle. The opening 21a connected to the through hole 22 is formed in the bottom center of the nozzle contact surface 21. Further, a flange 21b is formed on an outer periphery of the nozzle contact surface 21, and the ribs 23 extend to the flange 21b.

[0021] The bush component 20 is press-fitted into the recessed portion 13 in the head 10a of the sprue bush main body 10, whereupon the entire periphery of the flange 21b is laser-welded, for example, so as to be joined and fixed integrally to the head 10a of the sprue bush main body 10. At this time, the flange 21b of the nozzle contact surface 21 is flush with a front surface of the head 10a (see Fig. 1B and so on), whereby the nozzle contact surface 21 is supported by the ribs 23 and spaces provided between the ribs 23 are formed directly below the nozzle contact surface 21.

[0022] By providing a configuration in which the nozzle contact surface 21 of the bush component 20 is supported by the ribs 23 and spaces are formed between the ribs 23, the plurality of radial ribs 23 act as heat radiation fins such that the heat of the resin in the vicinity of the opening 21a in the nozzle contact surface 21 is radiated effectively to the spaces between the ribs 23. Moreover, the nozzle contact surface 21 can be reduced in thickness, thereby enhancing the effect of radiating heat from the nozzle contact surface 21. Hence, the vicinity of the opening 21a is cooled with greater efficiency such that the temperature of the resin in the vicinity of the opening 21a decreases earlier, and as a result, the occurrence of stringing is suppressed. Furthermore, by providing the radially disposed ribs 23 as a structure for supporting the nozzle contact surface 21, sufficient strength can be secured in the nozzle contact surface 21, which is contacted by the injection molding nozzle, while reducing the thickness of the nozzle contact surface 21, and therefore deterioration of the nozzle contact surface 21 can be suppressed. As a result, the durability of the sprue bush can be maintained.

[0023] Figs. 3A-3F to 7A-7F are views illustrating modified examples of the configuration of the bush component 20 according to the first embodiment, wherein each figure A in Figs. 3 to 7 is an external perspective view, each figure B in Figs. 3 to 7 is a side view, each figure C in Figs. 3 to 7 is a top view, each figure D in Figs. 3 to 7 is a bottom view, each figure E in Figs. 3 to 7 is an A-A sectional view of each figure D in Figs. 3 to 7, and each figure F in Figs. 3 to 7 is a B-B sectional view of each figure D in Figs. 3 to 7.

[0024] Figs. 3A-3F illustrate examples in which the number of ribs 23 is six and the through hole 22 has a six-pronged fork-shaped cross-section. Figs. 4A-4F illustrate examples in which the number of ribs 23 is eight and the through hole 22 has a circular cross-section. Figs. 5A-5F illustrate examples in which the number of ribs 23 is eight and the through hole 22 has a six-pronged fork-shaped cross-section. Figs. 6A-6F illustrate examples in which the number of ribs 23 is twelve and the through hole 22 has a circular cross-section. Figs. 7A-7F illustrate examples in which the number of ribs 23 is twelve and the through hole 22 has a six-pronged fork-shaped cross-section. The number of ribs 23 is not limited to the above examples, and another number, such as three or four, for example, may be employed, the number of ribs 23

being determined as a design matter in consideration of the thickness of the ribs 23 and the strength needed to support the thin nozzle contact surface 21. Further, as regards the sectional shape of the through hole 22, by employing a shape having a greater stringing prevention effect than a circular cross-section, such as a six-pronged fork shape, the stringing prevention effect can be enhanced. The sectional shape is not limited to a circular or six-pronged fork shape, and various other shapes, such as a star shape, for example, may be employed.

[0025] Figs. 8A-8E are views illustrating configurations of a sprue bush according to a second embodiment of the present invention, and Figs. 9A-9F are views illustrating configurations of the bush component 20 according to the second embodiment. More specifically, Fig. 8A is an external perspective view of the sprue bush, Fig. 8B is a sectional view, Fig. 8C is a sectional perspective view, Fig. 8D is a side view, and Fig. 8E is a top view. Further, Fig. 9A is an external perspective view of the bush component 20, Fig. 9B is a side view, Fig. 9C is a top view, Fig. 9D is a bottom view, Fig. 9E is an A-A sectional view of Fig. 9D, and Fig. 9F is a B-B sectional view of Fig. 9D.

[0026] The sprue bush according to the second embodiment is a modified example of the sprue bush according to the first embodiment, and therefore modified parts will be described mainly below, while parts that are not described specifically are assumed to be configured identically to the sprue bush according to the first embodiment.

[0027] In the sprue bush according to the second embodiment, a ring-shaped portion (a part of the head surrounding the peripheral surface of the recessed portion 13) 10a-1 forming the peripheral surface of the recessed portion 13 in the head 10a of the sprue bush main body 10is configured as a separate component that can be detached from the sprue bush main body 10. The ring-shaped portion 10a-1 forms an outside part constituting an outer side of a side face of the recessed portion 13 of the head 10a, and serves as a part of the head 10a that is obtained by partially dividing the head 10a along a perpendicular plane to the axial direction. A height of the ring-shaped portion 10a-1 is set to match a height (a depth) of the recessed portion 13.

[0028] The ring-shaped portion 10a-1 includes a pair of screw holes 12-1 that are aligned with the screw holes 12 in the head 10a, and using screw fastenings, the ring-shaped portion 10a-1 is integrated with the head 10a of the sprue bush main body 10, thereby realizing the sprue bush main body 10 and forming the recessed portion 13 of the head 10a. The bush component 20 is fitted into a central hole in the ring-shaped portion 10a-1, which corresponds to the recessed portion 13 of the head 10a. Preferably, a collar 23a is provided on each of the ribs 23 of the bush component 20 to ensure that the bush component 20 does not fall out of the ring-shaped portion 10a-1, and a step portion on which the collar 23a catch is provided on a peripheral surface of the central hole of the ring-shaped portion 10a-1. The bush component 20 is attached to the sprue bush main body 10 by placing the bush component 20 on the head 10a of the sprue bush main body 10 in a condition where the ring-shaped portion 10a-1 is not attached, and then screwing the ring-shaped portion 10a-1 to the sprue bush main body 10 so that the bush component 20 is housed in the central hole of the ring-shaped portion 10a-1. As a result, the bush component 20 is embedded fixedly in the recessed portion 13 of the sprue bush main body 10.

[0029] Figs. 10A-10F to 14A-14F are views illustrating modified examples of the configuration of the bush component 20 according to the second embodiment, wherein Figs. 10A, 11A, 12A, 13A and 14A are external perspective views, Figs. 10B, 11B, 12B, 13B and 14B are side views, Figs. 10C, 11C, 12C, 13C and 14C are top views, Figs. 10D, 11D, 12D, 13D and 14D are bottom views, Figs. 10E, 11E, 12E, 13E and 14E are A-A sectional views of Figs. 10D, 11D, 12D, 13D and 14D respectively, and Figs. 10F, 11F, 12F, 13F and 14F are B-B sectional views of Figs. 10D, 11D, 12D, 13D and 14D respectively.

[0030] The modified examples of the configuration of the bush component 20 according to the second embodiment, illustrated in Figs. 10A-10F to 14A-14F, are identical to the modified examples of the configuration of the bush component 20 according to the first embodiment, illustrated in Figs. 3A-3F to 7A-7F, except that the ribs 23 are provided with the collar 23a. Figs. 10A-10F illustrate examples in which the number of ribs 23 is six and the through hole 22 has a six-pronged fork-shaped cross-section. Figs. 11A-11F illustrate examples in which the number of ribs 23 is eight and the through hole 22 has a circular cross-section. Figs. 12A-12F illustrate examples in which the number of ribs 23 is eight and the through hole 22 has a six-pronged fork-shaped cross-section. Figs. 13A-13F illustrate examples in which the number of ribs 23 is twelve and the through hole 22 has a circular cross-section. Figs. 14A-14F illustrate examples in which the number of ribs 23 is twelve and the through hole 22 has a six-pronged fork-shaped cross-section.

[0031] Figs. 15A-15D are views illustrating further modified examples of the configuration of the bush component 20 according to an embodiment of the present invention. Fig. 15A is a sectional perspective view, Fig. 15B is a sectional view, Fig. 15C is a top view (illustrating half of a surface), and Fig. 15D is a partial side view. In this further modified example of the configuration of the bush component 20, the respective bush components 20 of the first and second embodiments are configured such that the nozzle contact surface 21, which is constituted by a depressed surface that curves in a circular shape, is formed to include a plurality of concentric circle-shaped concavo-convex surfaces.

[0032] Fig. 16 is a sectional view illustrating a condition in which an injection molding nozzle 30 contacts the nozzle contact surface of the bush component 20 illustrated in Figs. 15A-15D. The injection molding nozzle 30 contacts convex portions of the concentric circle-shaped

concavo-convex surfaces formed on the nozzle contact surface 21 so as to be supported by the ring-shaped lines or strip-form surfaces forming the convex portions of the concavo-convex surfaces, while ring-shaped spaces are formed between concave portions of the concentric circle-shaped concavo-convex surfaces and the injection molding nozzle 30. These ring-shaped spaces serve as heat radiation spaces from which heat is radiated from the nozzle contact surface 21. Hence, heat dissipation from the nozzle contact surface 21 is promoted, leading to enhancement in the cooling effect in the vicinity of the opening 21a, and as a result, the temperature of the resin in the vicinity of the opening 21a decreases earlier, thereby contributing to the prevention of stringing.

[0033] Further, the bush component 20 illustrated in Figs. 15A-15D is provided with a ring-shaped rib 24 in addition to the radially extending ribs 23 described above. The ring-shaped rib 24 serves as the outer periphery of the pipe-shaped portion 22a forming the through hole 22, and is provided to intersect the radial ribs 23. The ring-shaped rib 24, similarly to the radial ribs 23, is configured such that an upper end thereof is joined to the rear surface of the nozzle contact surface 21 and a lower end thereof contacts the bottom of the recessed portion 13. The ring-shaped rib 24, together with the ribs 23, provides the strength needed to support the nozzle contact surface 21, and the position and dimensions thereof are determined together with the number (the intervals between), thickness, and so on of the ribs 23 as design matters in consideration of the strength.

[0034] The shape of the nozzle contact surface 21 illustrated in Figs. 15A-15D is not limited to being applied to the nozzle contact surface of the bush component 20 according to the embodiments of the present invention, described above, and may also be applied to a nozzle contact surface of an integrated sprue bush in which the sprue bush main body and the bush component are not separated. More specifically, in a sprue bush that is attached to a mold used to mold synthetic resin and includes a nozzle contact surface that is contacted by an injection molding nozzle and a flow passage extending from an opening in the nozzle contact surface, through which synthetic resin injected from the injection molding nozzle flows, the nozzle contact surface is a depressed surface that curves in a circular shape and is formed with a plurality of concavo-convex surfaces.

[0035] The concavo-convex surfaces provided on the nozzle contact surface 21 are not limited to the concentric circle-shaped surface shape illustrated in Figs. 15A-15D and 16, and the concavo-convex surfaces may take any form as long as spaces where the injection molding nozzle and the nozzle contact surface 21 do not contact each other are formed between a plurality of contacting parts on a contact surface between the injection molding nozzle and the nozzle contact surface 21. For example, projections and recesses may be formed to extend radially in the circumferential direction, or concavo-convex surfaces may be formed by providing projections intermittently over the entire surface of the nozzle contact surface 21. The concavo-convex surfaces formed as a plurality of concentric circle-shaped steps, illustrated in Figs. 15 and 16, are useful for positioning the injection molding nozzle reliably. Moreover, the concavo-convex surfaces can be machined comparatively easily, and exhibit a superior heat radiation effect.

[0036] In a further embodiment of the sprue bush according to the present invention, the sprue bush constituted by the sprue bush main body and the bush component is formed integrally as a single component, rather than by combining these two components. The sprue bush having the above configuration, in which a hollow region is formed in the interior thereof, can be formed integrally using a so-called stereolithography technique. More specifically, a sprue bush that is attached to a mold used to mold synthetic resin includes a nozzle contact surface that is contacted by an injection molding nozzle, and a flow passage extending from an opening in the nozzle contact surface, through which synthetic resin injected from the injection molding nozzle flows, wherein a hollow region surrounding the flow passage is formed in an interior region on a rear surface side of the nozzle contact surface, and a plurality of ribs are provided to extend radially outward from an inner peripheral surface of the through hole. Even more specifically, a sprue bush that is attached to a mold used to mold synthetic resin is formed by coaxially integrating a disc-shaped head and a columnar shaft having a smaller diameter than the head, a flow passage through which synthetic resin injected from an injection molding nozzle flows being formed in an axial center that extends from the head to the shaft, the head including a nozzle contact surface that is contacted by an injection molding nozzle and includes an opening into the flow passage, a hollow region formed in the interior of the head on a rear surface side of the nozzle contact surface so as to surround the flow passage in a ring shape, and a plurality of ribs extending radially toward the hollow region from a peripheral surface of the flow passage.

[0037] The present invention is not limited to the embodiments described above, and needless to mention includes design modifications within a scope not departing from the spirit of the present invention, these design modifications including various modifications and amendments that could be arrived at by a person having common knowledge in the field of the present invention.

REFERENCE SIGNS LIST

[0038]

10	Sprue bush main body
10a	Head
10a-1	Ring-shaped portion
10b	Shaft
11	Sprue
12	Screw hole

13	Recessed portion
20	Bush component
21	Nozzle contact surface
21a	Opening
21b	Flange
22	Through hole (part of the sprue)
22a	Pipe-shaped portion
23	Rib
23a	Collar
24	Ring-shaped rib
30	Injection molding nozzle

Claims

1. A sprue bush attached to a mold used to mold synthetic resin, the sprue bush comprising:

a sprue bush main body that has a flow passage, through which synthetic resin injected from an injection molding nozzle flows, and a recessed portion formed in a surface of the sprue bush main body on a synthetic resin injection port side thereof; and
a bush component that is embedded in the recessed portion,
the bush component including:

a nozzle contact surface that is contacted by the injection molding nozzle;
a through hole that extends from an opening in the nozzle contact surface and communicates with the flow passage in the sprue bush main body so as to form the flow passage for the synthetic resin; and
a plurality of ribs that extend radially outward from a peripheral surface of the through hole.

2. The sprue bush according to claim 1, wherein respective upper ends of the ribs are joined to a rear surface of the nozzle contact surface, and respective lower ends of the ribs contact a bottom of the recessed portion.

3. The sprue bush according to claim 1 or 2, wherein the ribs are formed at equal intervals in a circumferential direction.

4. The sprue bush according to any one of claims 1 to 3, wherein the bush component includes a ring-shaped rib that intersects the ribs and surrounds an outer periphery of the through hole.

5. The sprue bush according to any one of claims 1 to 4, wherein the nozzle contact surface is a depressed surface that curves in a circular shape and has a concavo-convex surface formed thereon.

6. The sprue bush according to claim 5, wherein the concavo-convex surface of the nozzle contact surface is formed of a plurality of concentric circle-shaped steps.

7. The sprue bush according to any one of claims 1 to 5, wherein an outside part forming a side face of the recessed portion of the sprue bush main body can be detached from the sprue bush main body, and the bush component is embedded in the recessed portion by disposing the bush component in the position of the recessed portion of the sprue bush main body in a condition where the outside part is detached, and then attaching the outside part.

8. A sprue bush attached to a mold used to mold synthetic resin, the sprue bush having a nozzle contact surface that is contacted by an injection molding nozzle and a flow passage that extends from an opening in the nozzle contact surface, and through which synthetic resin injected from an injection molding nozzle flows,
wherein the nozzle contact surface is a depressed surface that curves in a circular shape and has a concavo-convex surface formed thereon.

9. A bush component for a sprue bush configured to include a sprue bush main body that has a flow passage, through which synthetic resin injected from an injection molding nozzle flows, and a recessed portion formed in a surface of the sprue bush main body on a synthetic resin injection port side thereof, and the bush component, which is embedded in the recessed portion,
the bush component comprising:

a nozzle contact surface that is contacted by the injection molding nozzle;
a through hole that extends from an opening in the nozzle contact surface and communicates with the flow passage in the sprue bush main body so as to form the flow passage for the synthetic resin; and
a plurality of ribs that extend radially outward from a peripheral surface of the through hole.

10. A sprue bush attached to a mold used to mold synthetic resin, formed by coaxially integrating a disc-shaped head and a columnar shaft having a smaller diameter than the head, a flow passage, through which synthetic resin injected from an injection nozzle flows, being formed in an axial center that extends from the head to the shaft,
the head including:

a nozzle contact surface that is contacted by the injection molding nozzle and includes an opening into the flow passage;

a hollow region that is formed in the interior of the head on a rear surface side of the nozzle contact surface so as to surround the flow passage in a ring shape; and

a plurality of ribs that extend radially toward the hollow region from a peripheral surface of the flow passage.

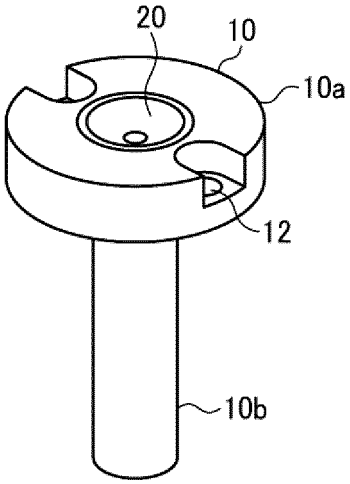


FIG. 1A

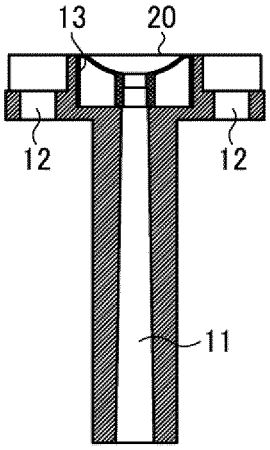


FIG. 1B

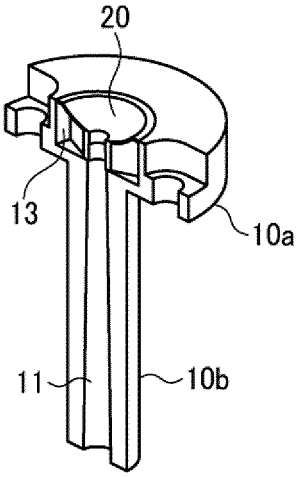


FIG. 1C

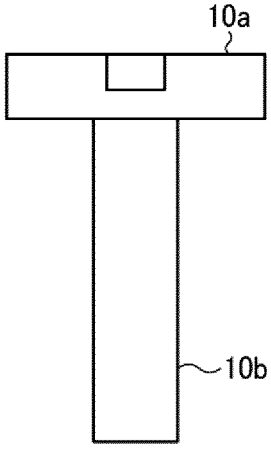


FIG. 1D

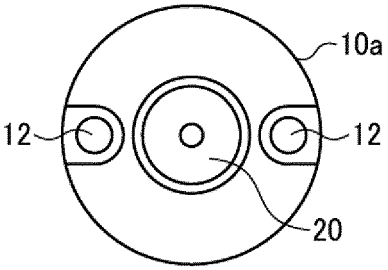


FIG. 1E

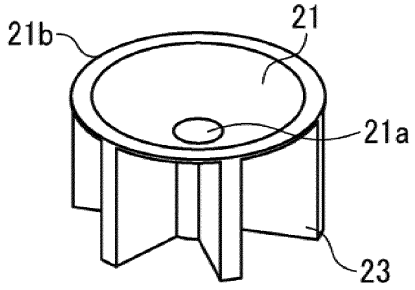


FIG. 2A

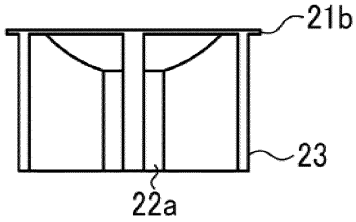


FIG. 2B

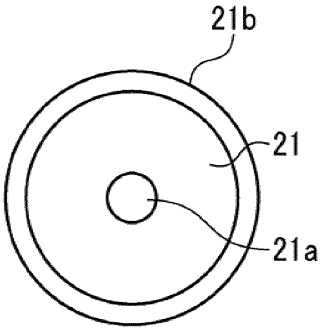


FIG. 2C

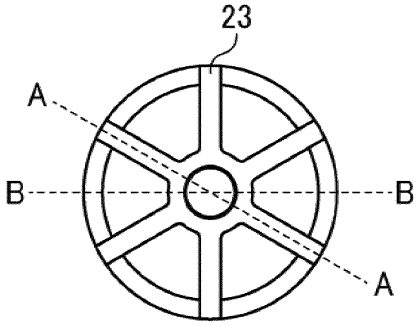


FIG. 2D

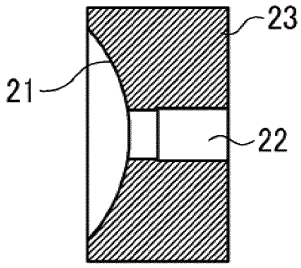


FIG. 2E

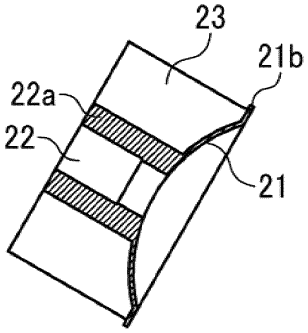


FIG. 2F

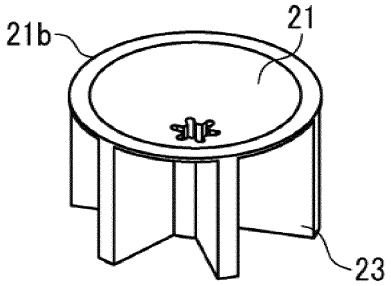


FIG. 3A

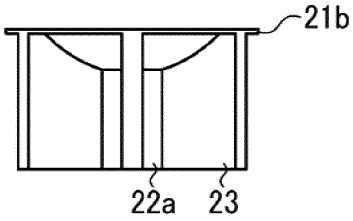


FIG. 3B

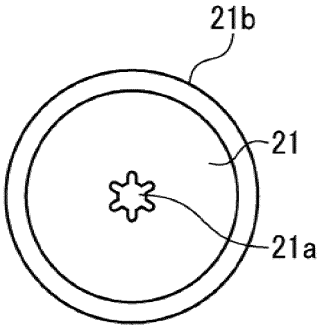


FIG. 3C

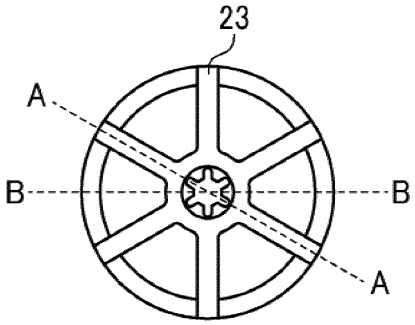


FIG. 3D

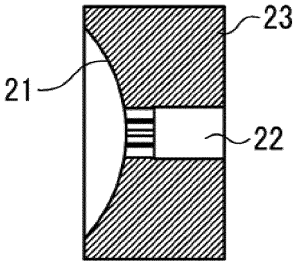


FIG. 3E

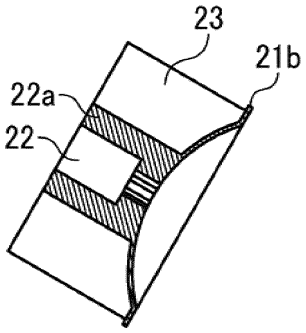


FIG. 3F

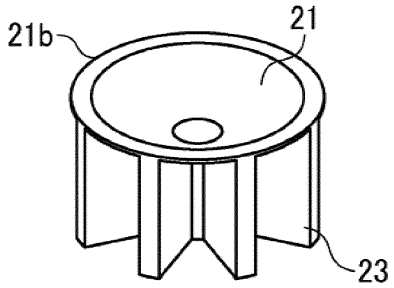


FIG. 4A

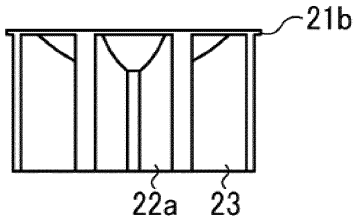


FIG. 4B

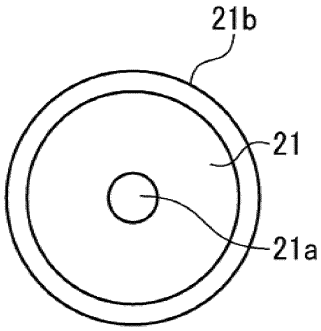


FIG. 4C

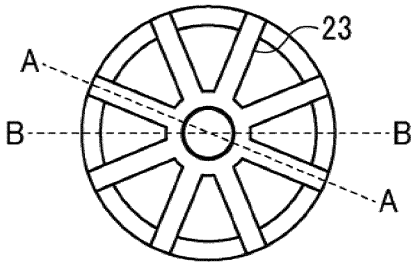


FIG. 4D

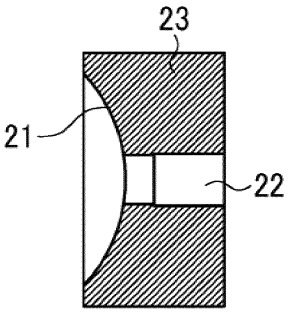


FIG. 4E

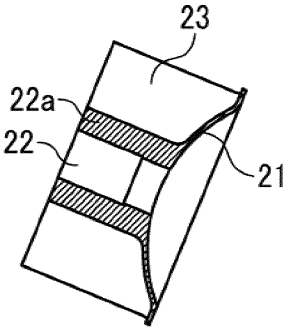


FIG. 4F

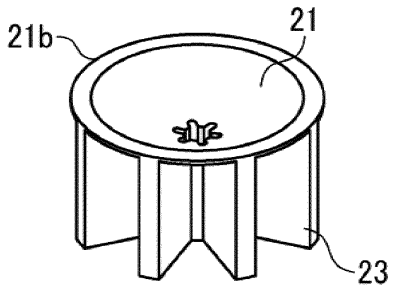


FIG. 5A

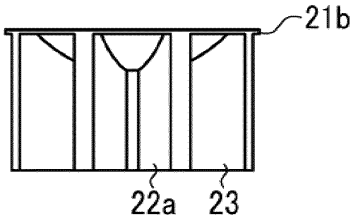


FIG. 5B

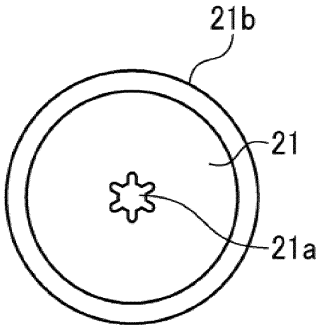


FIG. 5C

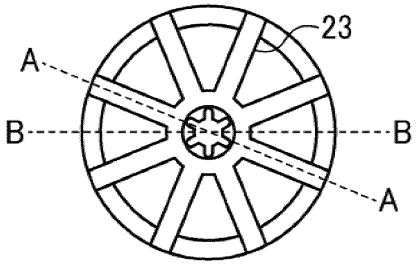


FIG. 5D

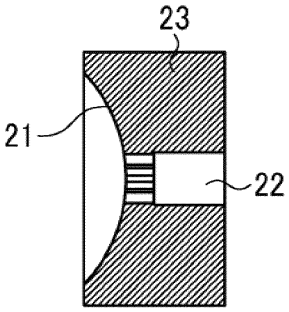


FIG. 5E

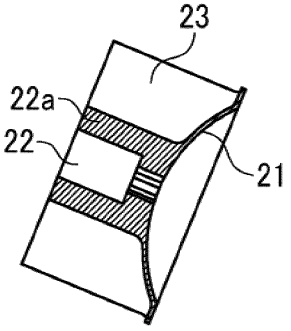


FIG. 5F

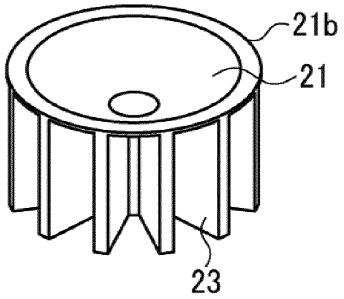


FIG. 6A

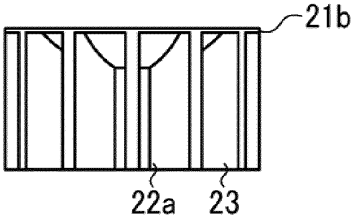


FIG. 6B

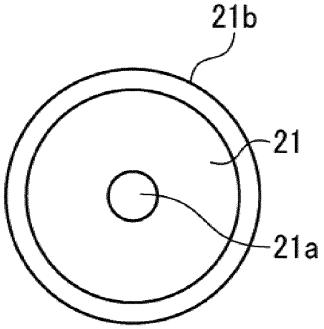


FIG. 6C

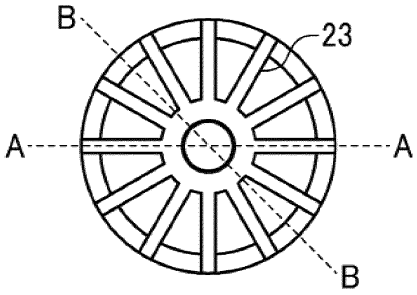


FIG. 6D

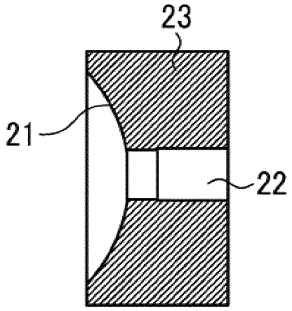


FIG. 6E

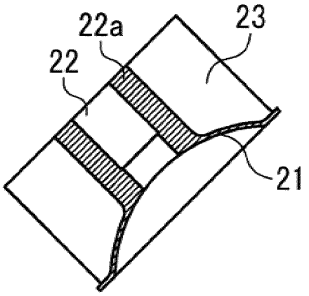


FIG. 6F

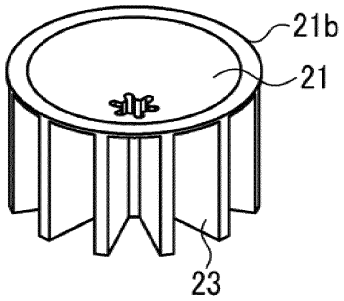


FIG. 7A

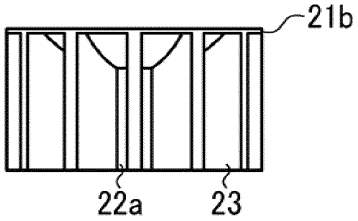


FIG. 7B

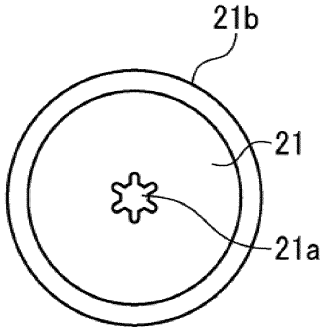


FIG. 7C

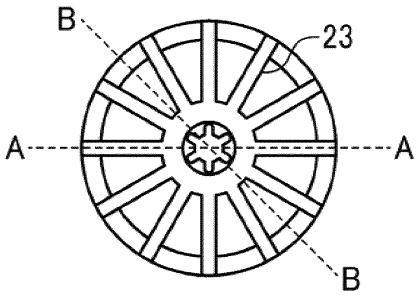


FIG. 7D

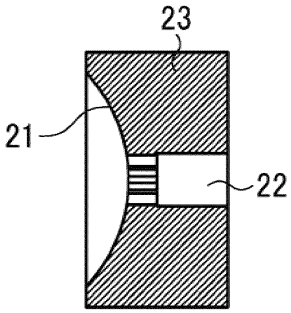


FIG. 7E

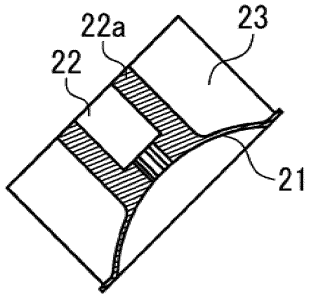


FIG. 7F

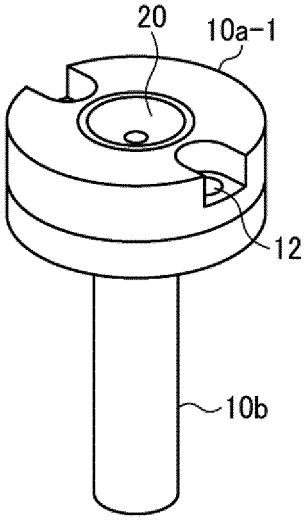


FIG. 8A

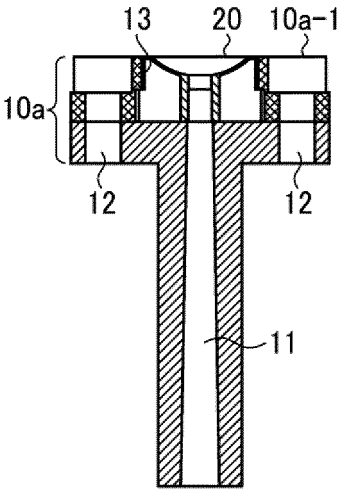


FIG. 8B

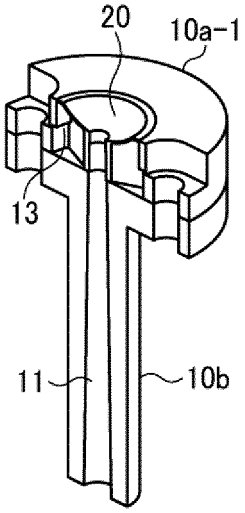


FIG. 8C

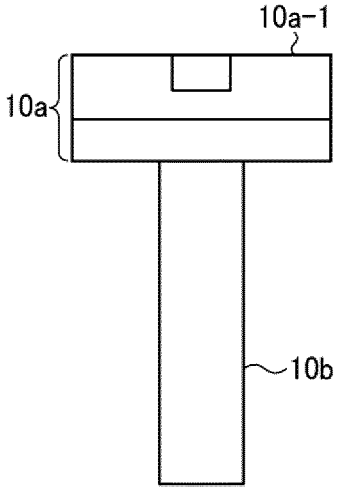


FIG. 8D

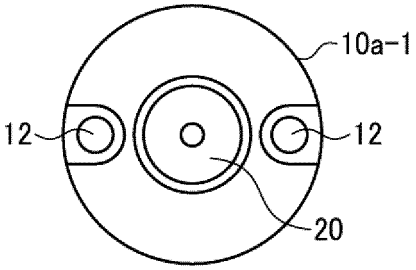


FIG. 8E

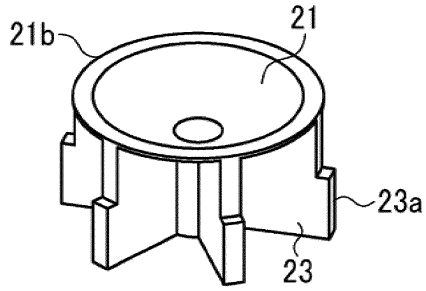


FIG. 9A

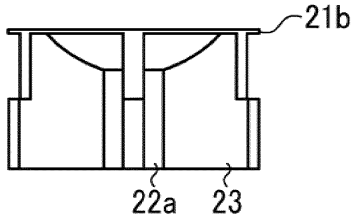


FIG. 9B

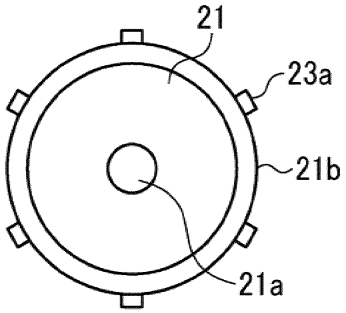


FIG. 9C

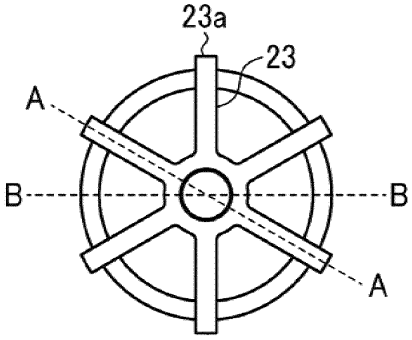


FIG. 9D

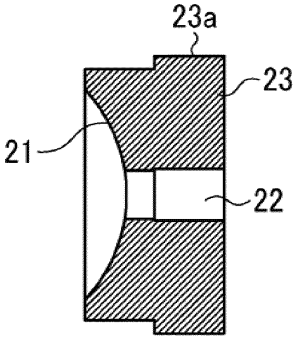


FIG. 9E

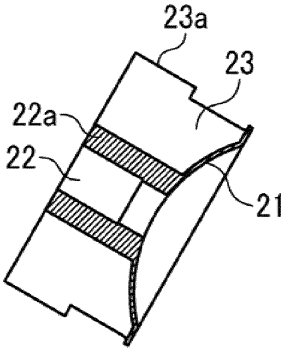


FIG. 9F

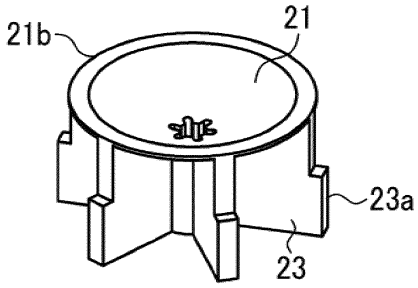


FIG. 10A

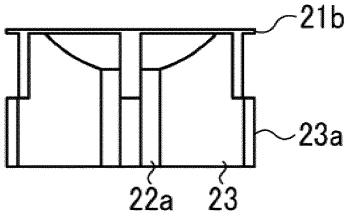


FIG. 10B

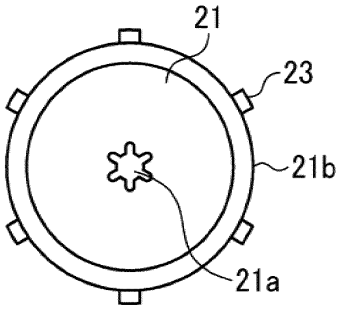


FIG. 10C

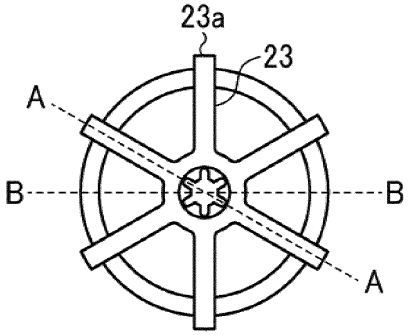


FIG. 10D

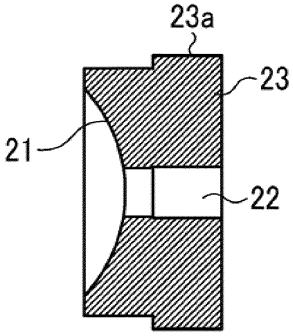


FIG. 10E

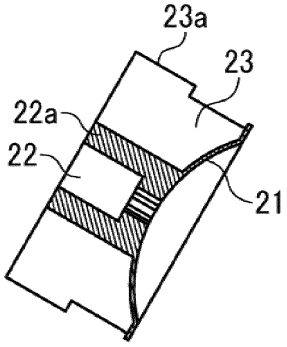


FIG. 10F

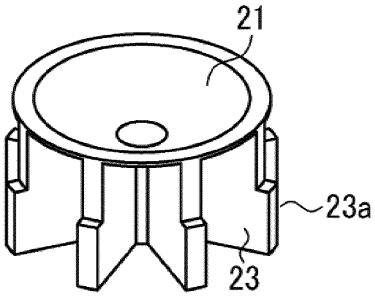


FIG. 11A

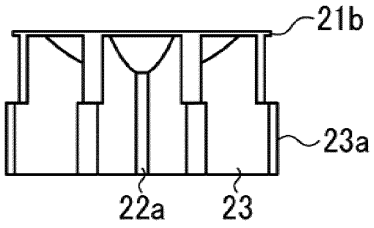


FIG. 11B

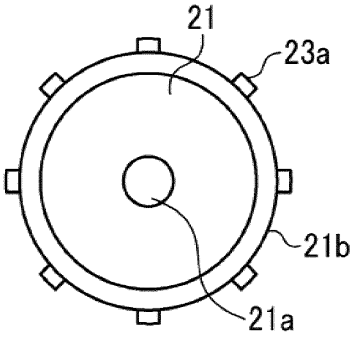


FIG. 11C

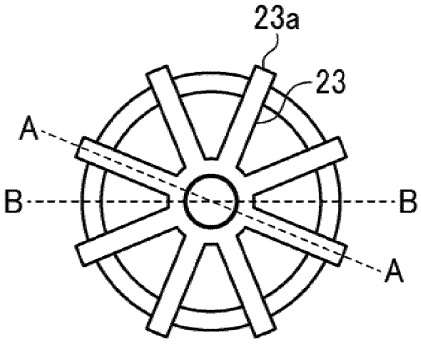


FIG. 11D

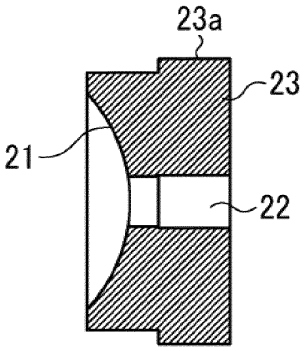


FIG. 11E

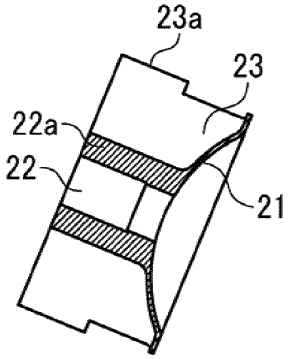


FIG. 11F

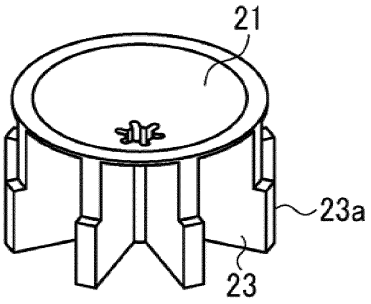


FIG. 12A

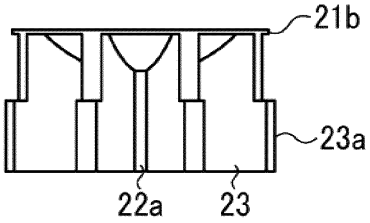


FIG. 12B

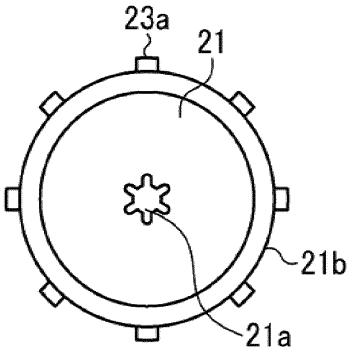


FIG. 12C

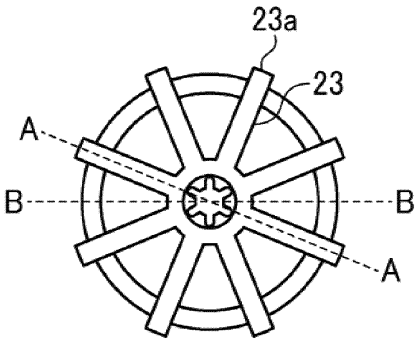


FIG. 12D

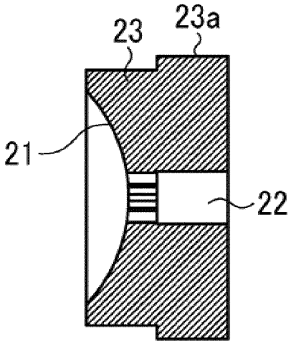


FIG. 12E

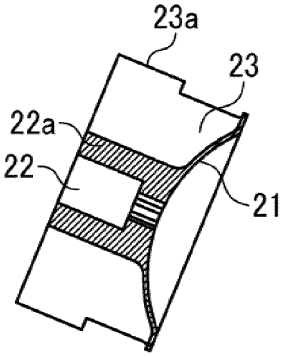


FIG. 12F

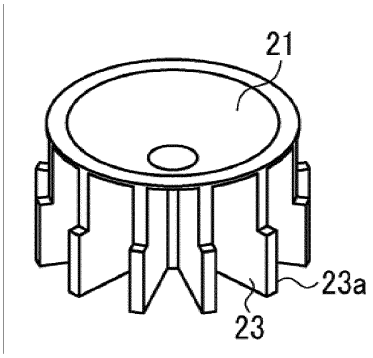


FIG. 13A

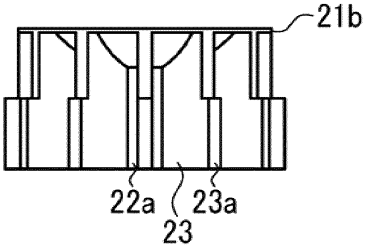


FIG. 13B

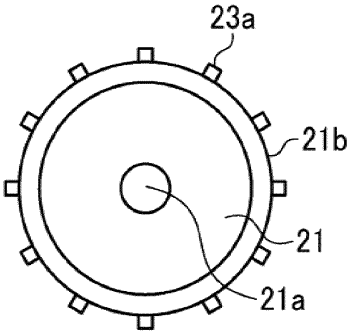


FIG. 13C

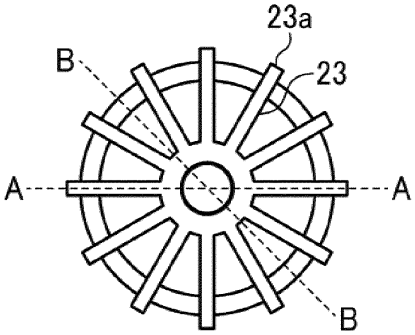


FIG. 13D

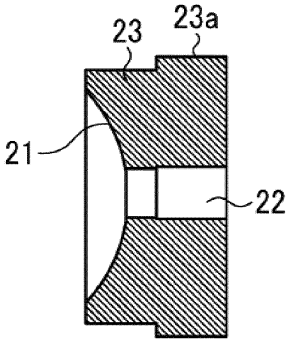


FIG. 13E

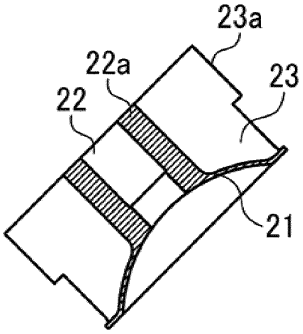


FIG. 13F

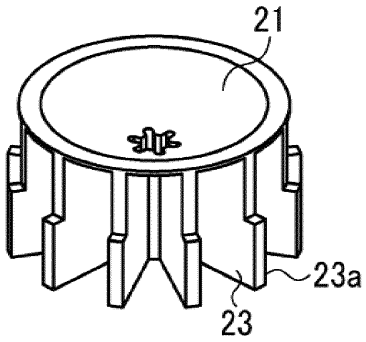


FIG. 14A

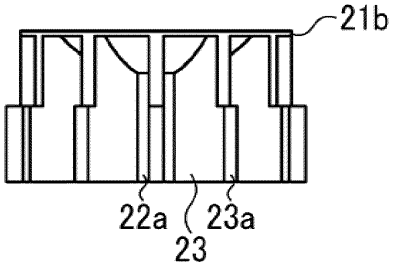


FIG. 14B

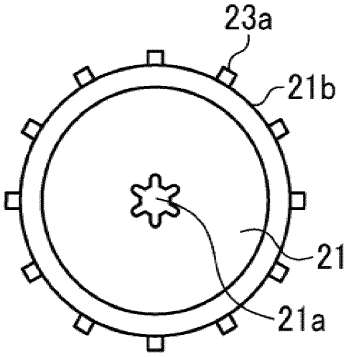


FIG. 14C

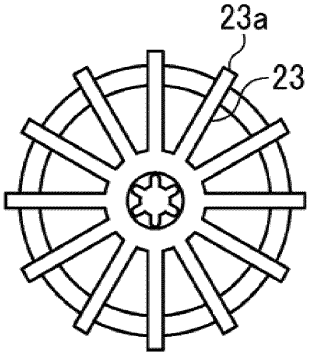


FIG. 14D

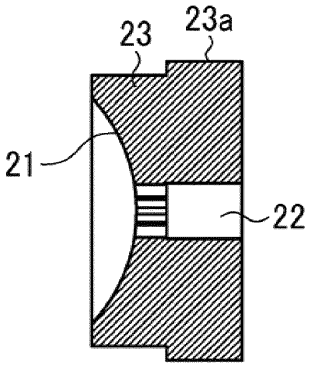


FIG. 14E

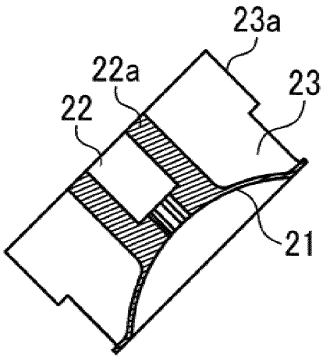


FIG. 14F

FIG. 15A

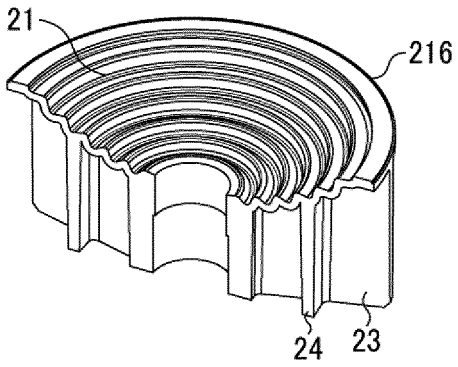


FIG. 15B

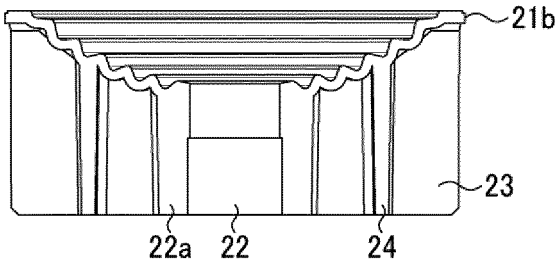


FIG. 15C

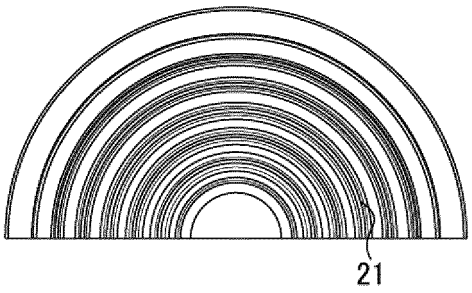


FIG. 15D

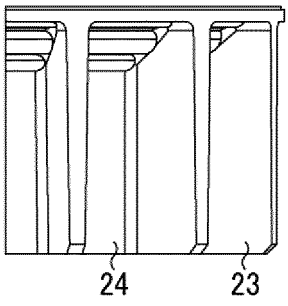
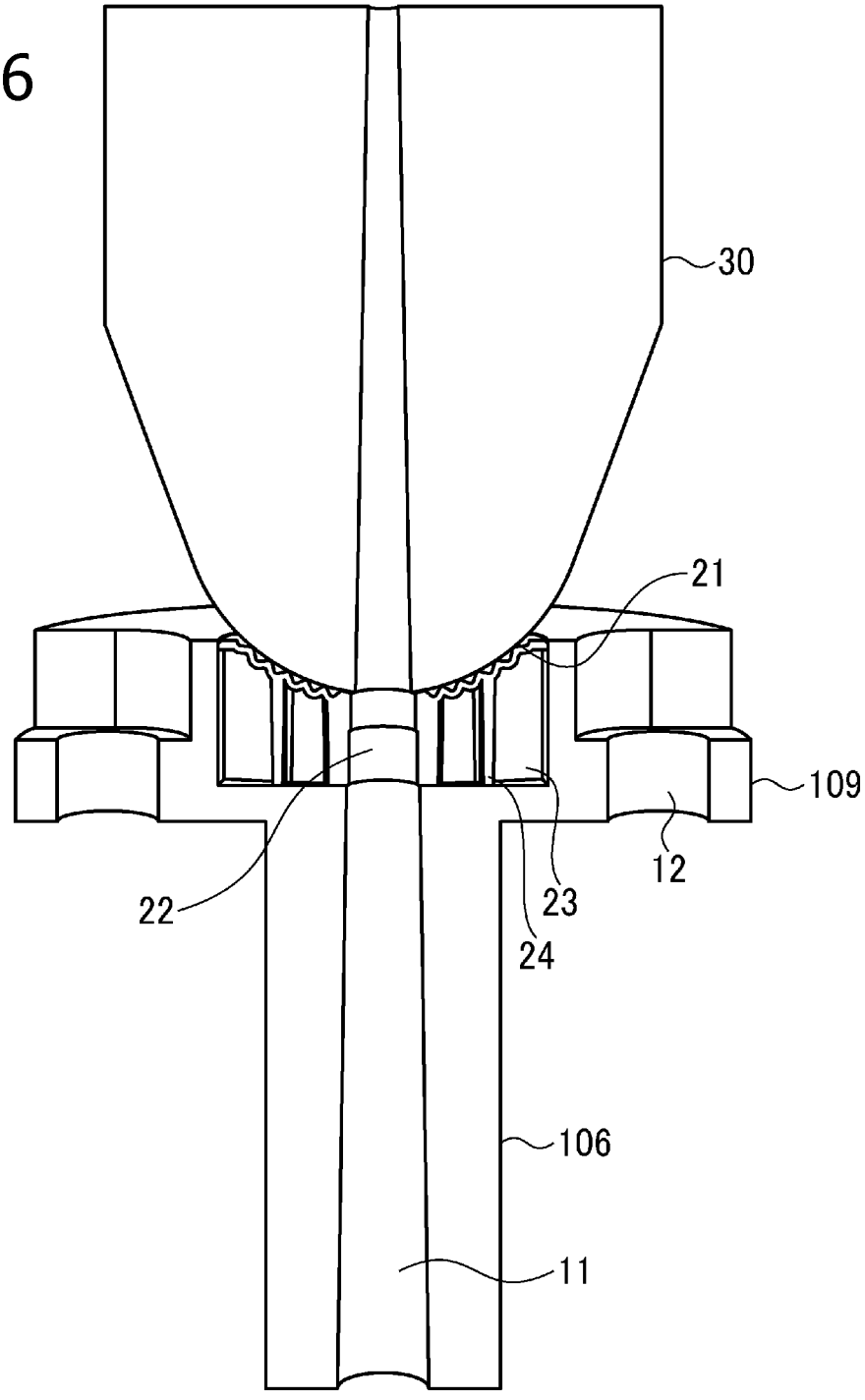


FIG. 16



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/086345

A. CLASSIFICATION OF SUBJECT MATTER
B29C45/27(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C45/27

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000-141419 A (Sumitomo Bakelite Co., Ltd.), 23 May 2000 (23.05.2000), paragraphs [0001] to [0004], [0008] to [0013] (Family: none)	1,3,9-10
A	JP 2004-066563 A (Koji NAKAGAKI), 01 March 2004 (01.03.2004), entire text; all drawings (Family: none)	1-10
A	JP 05-024080 A (Fuji Photo Film Co., Ltd.), 02 February 1993 (02.02.1993), entire text; all drawings (Family: none)	1-10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
02 February 2017 (02.02.17)	14 February 2017 (14.02.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/086345

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-068956 A (A.K.Technical Laboratory, Inc.), 16 March 2006 (16.03.2006), entire text; all drawings (Family: none)	1-10
A	JP 11-170307 A (Murata Mfg. Co., Ltd.), 29 June 1999 (29.06.1999), entire text; all drawings (Family: none)	1-10
A	JP 2000-006200 A (Sumitomo Bakelite Co., Ltd.), 11 January 2000 (11.01.2000), entire text; all drawings & EP 967062 A1	1-10
A	US 4069003 A (DINAMODE CORP.), 17 January 1978 (17.01.1978), entire text; all drawings (Family: none)	1-10
A	JP 2013-075504 A (Pla Moul Seiko Co., Ltd.), 25 April 2013 (25.04.2013), entire text; all drawings (Family: none)	1-10

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Patent documents cited in the description

- JP 2001246649 A **[0004]**
- JP 2008247014 A **[0004]**
- JP 2007083462 A **[0004]**
- JP 2014046537 A **[0004]**